Oklahoma.—Wheat prospects were never more unfavorable November 30 than this year. Much that was planted in September and October has remained as planted, not having sprouted, on account of want of moisture, and that which came up all right is dried up and dead to the surface of the ground, and some of our farmers say that many of the roots are dead also. On account of the continued low price of wheat and unfavorable conditions for fall sowing the acreage is possibly 25 per cent. less than last year, so that it looks as if next year's crop might be short.

Up to the present time there has been no fall pasturage to amount to anything, so that hay, straw, and other forage crops are commanding good prices. Straw, which in other years was allowed to rot in the fields, is now being carefully preserved and fed to stock. Stock water is exceedingly scarce and hard to get on the ranges, and cattle and horses have in many instances to be driven many miles to secure a supply.

South Dakota.—As a whole the month was unusually pleasant and favorable for late autumn farm work. The general absence of snow on the ground was very favorable for the continuous grazing of live stock on the ranges, thereby economizing the stock of cut hay, of which there was considerable shortage at the beginning of the winter or feeding season.

Tennessee.—Covington: The drought which began about the middle of September continued throughout the month, causing great scarcity of water throughout this section and serious damage to vegetation; forest fires have caused some loss of fencing, and in some places crops have suffered from the heat of the fires. Greenville: This has been the driest month of which we have any record; wheat is needing rain badly. Nunnelly: The weather during most of the month has been favorable for farm work; a considerable area has been sown in wheat; stock water is very scarce in some localities; forest fires have been raging a considerable portion of the month.

Utah.—A remarkably uneventful month; very clear, no precipitation whatever, no heavy winds; harvesting entirely finished, thrashing finished last week; the mildness of the fall has been very beneficial for the well-being of the beef stock.

NOTES BY THE EDITOR.

OBSERVATIONS AT HONOLULU, HAWAIIAN ISLANDS.

As the weather on our Pacific coast depends so largely upon the conditions of the atmosphere to the westward, it is considered important to publish in full and as soon as practicable the data furnished by observers in Alaska, the Hawaiian Islands, and adjacent regions.

Meteorological observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, Meteorologist to the Government Survey.

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied.

The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations daily.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

November, 1894.	Pressure at sea level.			Temperature.					Humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
									Relative.						
	9 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Minimum.	Maximum.	9 a. m.	9 p. m.	Absolute.	Direction.	Force.		
	Ins.	Ins.	Ins.	°	°	°	°	°	%	%					Ins.
1....	30.11	30.03	30.10	73	78	74	72	80	59	70	6.0	ne.	4	5	0.02
2....	30.12	30.03	30.11	71	79	73	71	80	80	70	6.8	ne.	3	8-4	0.05
3....	30.12	30.02	30.10	69	79	73	68	81	67	73	6.6	nne.	2	8-2	0.08
4....	30.05	29.97	30.04	73	80	67	72	81	56	83	6.1	ne-s.	2	5-0	0.00
5....	30.03	29.91	30.03	63	81	70	63	84	59	83	6.8	n-s.	1	1	0.00
6....	30.07	29.95	30.06	66	81	72	66	82	71	85	7.1	sw.	2	3	0.00
7....	30.04	29.93	30.02	67	80	73	67	82	75	80	7.1	sw.	2	2	0.00
8....	30.03	29.96	30.03	69	79	70	69	82	77	80	7.1	sw.	2	5-0	0.00
9....	30.09	29.99	30.07	68	81	71	66	81	74	85	7.2	sw.	2	2	0.00
10....	30.06	29.96	30.05	67	79	72	66	81	71	84	7.1	sw.	1	1-5	0.00
11....	30.03	29.91	29.98	70	77	70	70	80	80	83	7.1	w-ssw.	1	7	0.04
12....	29.95	29.87	29.93	67	79	75	67	80	70	77	6.9	sse.	4	3	0.00
13....	29.96	29.91	29.99	75	78	75	74	80	77	77	7.5	s.	4-2	8-4	0.00
14....	30.00	29.93	29.96	73	78	77	72	80	77	76	7.7	s.	3	10	0.00
15....	29.95	29.94	29.91	70	74	73	68	75	90	80	7.6	e-s-w.	1-4-1	10	1.77
16....	29.97	29.90	29.97	72	78	71	69	82	73	86	7.3	ne-s.	2	6-10	1.10
17....	30.02	29.96	30.08	68	80	75	68	82	75	77	7.2	ne.	3	3	0.00
18....	30.11	30.02	30.12	73	79	73	71	81	67	76	6.7	ne.	3	3	0.00
19....	30.10	30.01	30.10	67	77	70	65	79	80	80	6.3	nne.	3	5	0.00
20....	30.10	29.97	30.01	71	76	73	67	77	63	74	6.4	nne.	4	6	0.38
21....	30.00	29.95	30.01	71	76	74	66	77	72	74	6.8	ne.	4	8-3	1.02
22....	29.99	29.91	29.99	71	79	72	69	79	77	88	7.1	ne.	4	3-8	0.38
23....	30.04	29.94	30.02	71	78	73	69	82	75	85	7.5	s-ne.	3	10-8	0.18
24....	29.98	29.92	29.99	69	77	69	67	79	77	86	7.0	n-e.	2	3	1.70
25....	30.01	29.94	30.00	64	78	67	64	79	74	85	6.8	n-s.	1	3	0.00
26....	30.01	29.94	30.02	65	77	74	65	79	74	80	7.2	se.	2	5	0.00
27....	30.09	29.98	30.07	70	79	68	68	79	95	95	7.5	s.	1	5-2	0.47
28....	30.11	30.02	30.08	65	77	73	65	79	80	74	6.8	n.	1	6	0.07
29....	30.11	30.03	30.08	68	77	70	67	77	70	75	6.7	ne.	2-4	7	0.69
30....	30.12	30.05	30.12	67	72	70	67	75	68	67	5.8	nne.	4-6	6	2.40
	30.045	29.963	30.034	69.1	78.1	71.9	67.9	79.8	73.3	79.6	6.9				10.35

Mean temperature: 6+2+9÷3 is 73.0°; the normal is 74.0; extreme temperatures, 84° and 63°.

Thunderstorms: 22d, lightning at night; 24th, 2 a. m., thunderstorm from the sw.; 25th, lightning; 27th, thunderstorm from sw. up to 9 a. m.

High winds: S. to w.; storm 13th; heavy rain all over group, 15th, 21st, 29th, 21st, and 29th, northerly; squally; gale, nne., 30th. From 10 to 30 inches of rain at different points on Island of Hawaii for month; 8.31 inches of rain in 24 hours on the 21st at Hilo.

PROTECTION FROM FROST.

In response to numerous inquiries the following text is offered:

The proper limiting temperature at which the smudge fires should be lighted, the number of such fires, the best, namely the cheapest materials to use, all depend upon local circumstances, and must be determined on the spot for each special case. The general rule is that if the local temperature has fallen to 40° or 45° F. in the early evening, if the sky is clear and the wind light, and there is no reason to expect that it will cloud over or become foggy, or very windy, then it will be frosty in the early morning, at least in those spots that are specially liable to frost. If there is even a moderate breeze during the night the smudge smoke will be blown away and do but little good; but in still nights and places sheltered from the wind the smudge should be lighted before 9 p. m. and kept up until danger is past. The smudge materials most approved consist of mixtures of tar, oil, and the refuse from refineries, with wood chips, damp straw, leaves, peat, dried corn stalks, and the fine waste of soft coal. But all these materials are expensive, or in some cases very valuable as manure and as mulching, so that the farmer dislikes to burn them up. In many cases sprinkling with water is as satisfactory as smudging, and although this involves considerable labor, yet it is oftentimes more desirable. The water warms the plants and the soil; it adds moisture to the air and sometimes even may help to make a little local fog; it has to be put on several times during the night either with a hose or the watering pot. Potatoes, beans, and even orange trees have often been saved in this way. If there is plenty of water, little streams may be allowed to run down the furrows of the field; they give off warmth and moisture just as in the case of sprinkling. Cranberry bogs are flooded to prevent frost.

Covering with some sort of shield protects the plants from radiation and saves them from freezing, even though the surface of the ground may get very cold. Such covers may be made of tubs or half barrels; of conical caps of pasteboard, matting, or newspaper; of light wooden frames over which cambric or mosquito bar is stretched; of coarse matting or of rough trellis work. Sometimes a bolt of cloth is rolled up on a reel at one end of a row of plants, and two persons holding the end of the cloth walk down the row unrolling the cloth and covering the plants completely; short stakes should be placed along the row so that the screen will rest upon them a few inches above the plants. For a single night old newspapers are as useful as cloth. A gentleman in Washington has made a very serviceable screen of ordinary laths tied together about two inches apart on a pair of ordinary clothesline ropes; flexible wire will do as well; this screens against hot sun by day and frost by night, and can easily be rolled up out of the way when not in use. Old venetian blinds, japanese screens, or old floor matting are fair substitutes. Rows of vertical walls or screens tipped against each other, forming an A, do good service.

Rows of tall-growing plants set between the rows of delicate vegetation act as shields against wind and radiation. Thus tall hop vines on poles, tall corn or cane stalks, or pole beans protect the lower vegetation from cooling by radiation. When the plants are very small a mulching of straw may be spread over them for the night.

If the frost comes suddenly and there are no smudges or shields prepared, but there is on hand a barrel of grease, oil, tar, turpentine, or crude petroleum, then set the barrel on a wheelbarrow and roll it up and down the furrows, leaving streaks of the inflammable material on the ground. Set fire to the streaks after the barrel is safely out of the way.

Anything that can be done to stir up a rather rapid circulation of air will mix the colder air near the ground with the warmer air above it and greatly retard the cooling and the frost.

Ten per cent of protection from radiation will often save a crop almost as well as complete protection. A thermometer placed in an open spot in the field that is to be protected can easily be arranged to ring a bell automatically when the temperature falls to 40° or 45°. This temperature limit must be adjusted to suit each field and plant. Such a frost annunciator can easily be made if it is not to be found on sale in the shops and stores. A special design is now under consideration by the Weather Bureau.

HAS THE WIND ANY EFFECT ON THE THERMOMETER? DOES IT LOWER THE TEMPERATURE OF THE AIR TO SET IT IN MOTION?

The above questions have been propounded by one of the correspondents of the Weather Bureau, and a reply is desired for the general information of Weather Bureau observers. As above worded these questions may seem to involve two or three principles in physics:

1. When perfectly quiet air under a given barometric pressure is suddenly released from even a small portion of that pressure it expands; that is to say, it begins to move, but with this expansion occurs a lowering of temperature, so that from this point of view the temperature of the air is changed when the force that sets it in motion is simply the internal elastic pressure of the air itself. The temperature falls about 1° when its pressure falls 0.2 inch of the mercurial barometer. This conversion of static pressure or potential energy into momentum, or the kinetic energy of the wind, is important in the study of the mechanics of the atmosphere, but not so in ordinary local meteorological observations.

2. When the wind blowing over a country of varied topography raises the cool air from the lower valleys and stirs up the hot air over the plains and sunny nooks it thereby brings masses of different temperature to blow successively over a thermometer, and in that sense of the word it may be said that the wind has an effect on the thermometer.

3. When a thermometer is hung in the open air in such a way that the sun may shine upon it, or the sun's heat reflected from neighboring rocks and woodwork may strike it, or so that the bulb may radiate to the cold sky, the temperature of the thermometer will be in the first case warmer, in the last case colder, than that of the air in its neighborhood, and if now a wind blows upon it the thermometer will respectively fall or rise so as to attain a temperature nearer to that of the wind. This explains why Weather Bureau observers are always cautioned to obtain as near as possible the true temperature of the air by placing their thermometers within a light shelter, such that the wind can blow through freely without allowing the thermometer to be affected by any loss or gain of radiant heat.

4. When a violent wind blows against any obstacle the air is compressed on the windward side and generally is slightly expanded on the leeward side; the compression warms the compressed air and the thermometer reads higher than it would in air of the same temperature with a gentler wind; this warming may amount to 1° in extreme cases but is inappreciable for ordinary winds. The Weather Bureau instructions require the regular observers to whirl their thermometers at the rate of 10 feet per second on an apparatus provided within the thermometer shelter; in this way the effect of any small amount of injurious radiation is annulled, and the thermometer gives the temperature of the air that is at that time inside the shelter. Evidently it does not matter whether the thermometer moves through the air or the air blows past the thermometer.

THE WARM AIR ATTENDING LOW AREAS.

A general review of the development of areas of 20° rise or fall during November must impress one with the conviction that the temperatures experienced at the earth's surface depend quite as much upon dynamic warming and cooling as upon direct insolation, or the horizontal transfer of warm and cold air, or the protection afforded by cloudiness. When an area of low pressure appears in Alberta the cloud layer moves rapidly from the southwest over Washington, Oregon, and Idaho, giving that region rain or snow. This air may be said to be pushed, by the high pressure on the Pacific, northeastward over the crest of the Rocky Mountains; in its descent on the eastern side it produces the rapid rise of pressure chronicled in the above-mentioned areas of 20° rise. Similarly, any area or ridge of high pressure extending from the Rocky Mountain plateau westward feeds the low areas on the eastern slope with descending warm air, the maximum rise of temperature being usually quite near the area of lowest pressure, and on its southeast or southwest side. The fact that this air is descending the eastern Rocky Mountain slope and, therefore, being dynamically warmed is so apparent that one is apt to forget that it must also have an additional descending motion independent of, and often steeper than that of the slope of the land. This latter fact becomes more impressive as the low area moves eastward into the comparatively flat country of the Mississippi Valley and Lake region.

On the other hand, when a low pressure in the Mississippi or Ohio valleys has a high area on the southeast side, pushing in from the Atlantic, the region of 20° rise is on the east or southeast side of the low, showing that the air which is being pushed from the Atlantic High into the low area is again, as before, descending and warming. In general, therefore, the air that flows into a low area on its southwest, south, and southeast sides, has a descending component sufficiently rapid to produce an appreciable warming effect independent of the presence of mountain ranges; it is, therefore, not a fœhn wind or chinook in the technical sense of the word, although, like these, it owes its warmth to descent and compression. The maps from November 10, 8 p. m., to the 13th, afford an excellent illustration of this dynamic formation of a small area of high temperature on the south side of a low pressure within masses of air that have passed east over the Rocky Mountains, and the maps of the 14th, a. m., to the 15th, a. m., show a repetition of this process. The map of the 15th, p. m., shows a warm area in the Ohio Valley, due to the flow of descending air from the high pressure on the coast of the Atlantic, and the map of the 17th, a. m., apparently repeats this process in the same region, while at the same time it shows the northern Rocky Mountain slope covered with a warm area, descending from the ridge of high pressure that covers the plateau.

ATMOSPHERIC WAVES.

The origin of the areas of high and low pressure and the mechanical explanation of their continuance for several days or weeks has been a subject of many hypotheses and investigations. Sir John Herschel and William Birt were inclined to look upon them as the ridges and troughs of waves in the atmosphere similar to those of the ocean. Ferrel studied the connection between the winds and pressures as though he thought the low pressures were essentially due to cyclonic and the high pressures to anticyclonic systems of winds. In his "Preparatory Studies" the Editor has considered the movements of the atmosphere as analogous to the turbulent flow of a river in which ascending rushes and descending eddies alternate with each other, and where the pressures at the bottom of the stream must depend upon the irregularities of the local resistances almost as much as upon the centrifugal forces within the eddies. In such a river the motions within the eddies and rushes are not merely small disturbances in the general flow of the water, but are in reality the general flow itself distorted into innumerable complicated curves. On the surface of such a river at flood stage and superposed upon the eddies that pervade its depths one may see a system of surface waves reflected from shore to shore, or a system of standing waves below any special obstacle.

The atmosphere doubtless presents such phenomena as these, and also other but similar waves of pressure depending on heat, on the evaporation and condensation of aqueous vapor, on lunar and solar tides, and even on great eruptions such as that of Krakatoa. The lower atmosphere is moreover, subject to a system of waves produced by the horizontal motion of the upper atmosphere over it, just as the wind produces waves in the ocean. This latter class of waves has been investigated by von Helmholtz (reprinted in the work entitled "Mechanics of the Atmosphere") and has led to the suggestion by others, that when such systems of waves cross each other the atmosphere is thereby divided into a systematic tessellated series of areas of high and low pressures, and that in this way areas of high and low pressure may originate. But if these waves are in progressive motion the resulting areas will move, and will therefore endure but a very short time at any one spot, thereby differing so much from the observed duration of highs and lows that this wave formation can scarcely explain the movements of these areas. It is, however, conceivable that in rare and special cases the low area thus formed may contribute to the expansion and cooling and formation of fog, cloud, or rain in the lower strata, and that under favorable circumstances the change thus initiated may develop into a local disturbance and grow into an extensive storm.

The Editor finds but rarely occasion to refer to atmospheric waves in his notes explanatory of the phenomena dealt with in the WEATHER REVIEW, because a daily chart of the whole Northern Hemisphere is needed in order to study them. On the other hand the great masses of air in motion afford daily illustrations of the powerful action of the centrifugal force due to the diurnal rotation of the earth, by reason of which cold or dry and, therefore, denser air is driven rapidly toward the equator, thereby pushing warmer, moister, and lighter air back toward the pole. The high pressure areas seem to result from this dynamic action.

METEOROLOGICAL TABLES.

[*Prepared by the Division of Records and Meteorological Data.*]

The following pages present in tabular form the climatological data for the current month, on which the text of the preceding part of this REVIEW has, to a large extent, been based.

For a detailed description of the methods of observation, compilation, and computation relating to these tables, the reader is referred to page 129 of the MONTHLY WEATHER REVIEW for March, 1894. The general contents of the tables are as follows:

Table I gives for 140 Weather Bureau stations, making two observations daily, and for 10 others making only one observation, the ordinary climatological data.

Table I *a* gives for 140 Weather Bureau stations, making two observations daily, the monthly extremes and means of the temperature of the wet-bulb thermometer at 8 a. m. and 8 p. m., seventy-fifth meridian time.

Table II gives for about 2,200 stations, occupied by voluntary observers, the mean and extreme temperatures and the total precipitation.

Table III gives climatological data for about 30 Canadian stations.

Table IV *a* gives for 38 Weather Bureau stations the percentages of sunshine for each hour of local mean time.

Table IV *b* gives for 43 Weather Bureau stations the total hourly rainfall for each hour of seventy-fifth meridian time.

Table V gives for 81 stations the mean temperatures for each hour of seventy-fifth meridian time.

Table VI gives for 66 stations the mean pressures for each hour of seventy-fifth meridian time.

Table VII gives for 138 stations the mean hourly movement of the wind.

Table VIII gives for 68 stations the resultant movements and directions of the wind from continuous registration.

Table IX gives for 140 stations the component and resultant directions of the wind based on simultaneous observations at 8 a. m. and 8 p. m., seventy-fifth meridian time.

Table X *a* gives for 47 voluntary stations the normals and current departures of mean monthly temperatures.

Table X *b* gives for the same stations the similar data as to precipitation.

Table XI gives for each day of the month the number of thunderstorms (T), and of auroras (A), reported by all the observers of each State.

Table XII gives the principal climatic features of the month as reported by each State weather service.